United States Environmental Protection Agency
Air and Radiation Stratospheric Protection Division 6205J
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DETAILED QUESTIONS ABOUT HC-12A®, OZ-12®, AND OTHER FLAMMABLE REFRIGERANTS

Ozone Protection Hotline toll-free (800) 296-1996 • Ozone Protection Hotline direct dial (301) 614-3396
EPA SNAP World Wide Web Site: http://www.epa.gov/ozone/title6/snap/

HC-12a® and OZ-12®

- *What are HC-12a® and OZ-12®?*

HC-12a® and OZ-12® brand hydrocarbon refrigerant blends are flammable refrigerants. Their primary components are hydrocarbons, which are flammable substances like propane and butane. HC-12a® and OZ-12® are registered trademarks of OZ Technology, Inc. HC-12a® has been marketed since 1994. OZ-12® was a similar blend marketed until the introduction of HC-12a®. Both products have been reviewed by EPA under the Significant New Alternatives Policy (SNAP) program. More information about the SNAP program is available from the hotline and world wide web site listed at the top of this page.

- *What is the legal status of HC-12a® and OZ-12®?*

Since July 13, 1995, it has been illegal to replace CFC-12 with HC-12a® in any end-use other than industrial process refrigeration. This includes motor vehicle air conditioners. The same prohibition for OZ-12® took effect on April 18, 1994.

- *May HC-12a® be used to replace CFC-12, commonly referred to as "Freon®," in cars?*

No. It is illegal to use HC-12a® as a substitute for CFC-12 in automobile or truck air conditioning under any circumstances. The manufacturer, OZ Technology, has not adequately responded to EPA's concerns about the safety of using a flammable refrigerant in a system not designed for it.

- *How did EPA make this determination?*

The Clean Air Act of 1990 required EPA to establish a program to review substitutes for ozone-depleting refrigerants. EPA's Significant New Alternatives Policy (SNAP) program carries out this mandate. Manufacturers of substitutes must submit information to EPA about the products, including ozone depletion potential, global warming potential, and toxicity and flammability data. EPA then compares these characteristics to both the refrigerant being replaced and the other available substitutes.

Most refrigerants submitted to EPA for review under SNAP have been found acceptable. A full list of alternatives is available either from EPA's Ozone Depletion world wide web site (http://www.epa.gov/ozone/title6/snap/) or from EPA's Ozone Hotline at 800-296-1996. In particular, several refrigerants have been listed acceptable for use as CFC-12 substitutes in motor vehicle air conditioning, subject to certain conditions on their use. Each acceptable alternative refrigerant has been demonstrated to a) be safer for human health and the environment than the original refrigerant, and b) pose a level of risk similar to that of other acceptable alternatives.

Flammable refrigerants pose a special challenge, because air conditioning and refrigeration systems in the US have been designed to use nonflammable refrigerants. They are not designed to protect users, service technicians, and disposal personnel from the possibility of fire. Therefore, the use of flammable refrigerants in existing systems poses a risk not found with nonflammable fluids.

Although new systems may be designed to provide that protection, they are not designed so today. Demonstrating that a flammable refrigerant can be used safely in current systems, whether existing or new, requires a comprehensive, detailed, scientifically valid risk assessment. EPA has required a risk assessment for flammable refrigerants since the inception of the SNAP program in 1994. An assessment must address potential leak scenarios such as collisions, servicing errors, and disposal procedures. In addition, it must consider ignition sources ranging from cigarette lighters or matches to sparks caused during a collision.

OZ Technology has submitted reports that purportedly demonstrate the safety of using OZ-12™ and HC-12a® in systems not designed to use such flammable refrigerants. However, after careful review of each document, EPA determined that they did not represent valid risk assessments. Until such assessments are performed, EPA believes that flammable refrigerants like HC-12a® and OZ-12® pose potential risks not present when using nonflammable refrigerants. In every end-use, numerous nonflammable options exist that do not pose an undue risk to human health or the environment. For these reasons, EPA does not allow the use of HC-12a® as a substitute for CFC-12 outside of industrial process refrigeration.

- *Why is it legal to use HC-12a® as a CFC-12 substitute in industrial process refrigeration, but not elsewhere?*

The industrial process refrigeration end-use includes systems designed to cool industrial manufacturing processes. It does not include any air conditioning system, so the direct risk to human health is reduced. Access to the areas near these systems is restricted. In addition, other regulations protect the safety of industrial workers. Finally, several large petrochemical companies have long experience using hydrocarbon refrigerants, and EPA believes they may continue to do safely.

Flammability risk depends a great deal on the system being discussed, and EPA determines the safety of a substitute based on the specific characteristics of each type of system. Therefore, despite the acceptability of hydrocarbon refrigerants (like HC-12a®) in this end-use, it is illegal to replace CFC-12 with hydrocarbon refrigerants in other types of refrigeration and air conditioning systems.

- *Gasoline and brake fluid are flammable, but they're allowed. Why not HC-12a®?*

EPA was required by Congress to ensure that substitutes for ozone-depleting substances did not pose risks to human health or the environment beyond those posed by the original products or by other acceptable substitutes. CFC-12 is an ozone-depleting refrigerant used in motor vehicle air conditioning; therefore EPA reviews substitutes for this refrigerant under the SNAP program. Unlike CFC-12, gasoline and other flammable fluids do not replace ozone-depleting products, so the SNAP program does not control their use.

However, there are good reasons why gasoline and other fluids may be used safely while the use of HC-12a® may not be safe. Gasoline and other flammable substances are used in systems designed specifically for flammable fluids. A gas tank is deliberately placed in the middle of the rear part of a vehicle to protect it against collisions. Air conditioner condensers, in contrast, are placed at the very front of the car to maintain good air flow. Unfortunately, this location means that condensers are vulnerable to being punctured during a front-end collision. Another difference is that gasoline lines do not enter the passenger compartment. Air conditioners must include lines that enter the passenger compartment to provide cooling. Flammability risk is extremely dependent on the specific system being considered; the simple presence of other flammable fluids in a car does not mean that using HC-12a® in an automobile air conditioner is safe.

- *Is sale of either OZ-12® or HC-12a® legal?*

Sale is not regulated under EPA's SNAP program. However, statutes and regulations issued by other federal, state, or local agencies may control the sale of these products, including illegal advertising.

- *Since the autoignition temperature of HFC-134a is lower than that of HC-12a, doesn't that mean that HFC-134a is more flammable than HC-12a?*

According to Underwriters Laboratories and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), hydrocarbons are flammable materials. Flammability, as defined by the ASTM E-681 standard test procedure for refrigerants, means that a substance will ignite at atmospheric pressure when mixed in some concentration in air at normal temperature and pressure. The minimum and maximum concentrations at which ignition will occur are called the lower and upper flammability limits. Hydrocarbons, like the components of HC-12a®, become flammable at concentrations as low as 2% by volume. These values are well-established in published literature. Autoignition temperature is a distinct measure from flammability limits in air. Specifically, this test measures the temperature at which a substance will spontaneously ignite, without any external ignition source like a match or lighter.

Certain documents claim that because the autoignition temperature of HFC-134a is below 750 degrees Celsius (1382 degrees Fahrenheit), it is flammable, and because the autoignition temperature of HC-12a® is above 750 degrees Celsius, it is nonflammable. However, this statement misrepresents the procedure used by Underwriters Laboratory, which classifies refrigerants somewhat differently from ASHRAE.

UL first examines whether a refrigerant burns in air at some concentration and normal pressure and temperature. If it does ignite under these conditions, it is classified as *flammable*. Hydrocarbons, like the components of HC-12a®, are classified this way. (Note that OZ Technology itself recognizes that HC-12a® is flammable, and labels HC-12a® containers with the word "flammable.")

If the refrigerant does not exhibit flammability limits in air, UL uses the autoignition temperature to distinguish between *practically nonflammable* refrigerants (meaning the autoignition temperature is below 750 degrees Celsius) and *nonflammable* refrigerants (meaning the autoignition temperature is above 750 degrees Celsius). HFC-134a does not ignite, regardless of concentration, at normal temperatures and pressures. It is classified by UL as practically nonflammable because its autoignition temperature is below 750 degrees Celsius. Note that UL lists most alternative refrigerants as practically nonflammable.

- *What is a second-generation substitute? Does the SNAP program regulate second-generation substitutes? Why can HC-12a® be used to replace HFC-134a in cars? Is the 134a system safer than one that uses CFC-12?*

Under the SNAP rule, EPA regulates substitutes for ozone-depleting substances. CFC-12 depletes the ozone layer, so EPA reviews substitutes for CFC-12; acceptable alternative refrigerants used to directly replace ozone-depleting substances such as CFC-12 are called "first-generation" substitutes. Because certain first-generation substitutes, such as HFC-134a, do not threaten the ozone layer, EPA does not review substitutes for these refrigerants. Substitutes for non-ozone-depleting first-generation substitutes are called "second-generation" substitutes.

However, the fact that EPA does not regulate the use of second-generation substitutes does not necessarily mean that such use is either legal or safe. For example, EPA is aware that sixteen states prohibit the use of flammable refrigerants in automobiles. In addition, local fire codes may restrict the use of hydrocarbon refrigerants like HC-12a®. Finally, the safety of using HC-12a® in a system designed for HFC-134a is not likely to be very different from the safety of using it in a system designed for CFC-12, and EPA does not believe HC-12a® has been proven to be a safe substitute for CFC-12 in motor vehicle air conditioning systems.

- *What is a "sham retrofit"?*

EPA does not regulate the use of HC-12a® as a substitute for HFC-134a. Certain materials have circulated claiming that by first converting a system from CFC-12 to HFC-134a, the system may then be converted to use HC-12a® without violating the original prohibition against using HC-12a® as a substitute for CFC-12. Thus, the question arises about the definition of a legitimate retrofit. This definition hinges on two distinct principles: complying with the conditions placed on using HFC-134a under the SNAP program, and the intent of the retrofit.

In accordance with the SNAP rules, a retrofit from CFC-12 to HFC-134a must include all of the following. The CFC-12 must be completely recovered in accordance with regulations issued under section 609 of the Clean Air Act. Fittings designed for use with HFC-134a must be permanently attached to the system. These fittings mechanically prevent the mixing of HFC-134a with CFC-12 and other refrigerants. Finally, the system must be labeled, and the label must contain detailed information as described by the SNAP rule. Performing these activities complies with the letter of the SNAP rule of June 13, 1995 (60 FR 31092).

Even such compliance may not, however, indicate a legitimate retrofit. For example, HFC-134a must be used with a different lubricating oil from CFC-12; if the lubricant is not changed, the air conditioner will not work. Similarly, if the car is charged with less than a full charge of HFC-134a, the air conditioner will not work. Such actions indicate that the technician does not truly intend to convert the car's air conditioner to work with HFC-134a. Subsequent use of HC-12a® may violate the prohibition against its use as a CFC-12 substitute.

Other indications of a sham retrofit also exist, including the timing of the retrofit. In general, if a car arrives in a repair shop containing CFC-12 and leaves containing HC-12a®, it is likely that it underwent a sham retrofit, regardless of what actually occurred in the shop. Such a temporary retrofit to HFC-134a was likely intended solely to allow the use of HC-12a® in a car designed to use CFC-12. EPA is currently investigating several complaints, and believes indications such as those described above support a finding of a violation.

- *May HC-12a® be vented?*

No. Since November 15, 1995, the Clean Air Act has prohibited the venting of any refrigerant during the service, maintenance, repair, or disposal of air conditioning and refrigeration systems. When working on a system containing HC-12a®, the technician must recover the refrigerant into a suitable container and safely dispose of it.

- *What other regulations restrict the use and handling of HC-12a®?*

In addition to the prohibition on use described above, and the federal law banning the venting of HC-12a®, there are also state and local statutes and regulations that relate to certain uses of hydrocarbons. As of the printing date of this fact sheet, EPA is aware that the following states prohibit the use of flammable refrigerants like HC-12a® in automobile air conditioners: Arkansas, Arizona, Connecticut, Florida, Idaho, Indiana, Kansas, Louisiana, Maryland, North Dakota, Oklahoma, Texas, Utah, Virginia, Washington, and the District of Columbia.

Local fire codes also often restrict the storage of flammable materials. In addition, other federal, state, and local regulatory agencies may have regulations related to flammable refrigerants like HC-12a®. Check with these authorities for more information.

- *Are there other refrigerants that can replace CFC-12?*

A full list of alternative refrigerants is available either from EPA's Ozone Depletion world wide web site at http://www.epa.gov/ozone/title6/snap/ or from EPA's Ozone Hotline at 800-296-1996. In addition, the fact sheet titled “Choosing and Using Alternative Refrigerants for Motor Vehicle Air Conditioning” lists motor vehicle refrigerants and conditions on their use.

Flammable Refrigerants in General

- *Are there advantages to flammable refrigerants?*

Many flammable refrigerants offer potential energy efficiency savings, lower global warming potentials, low toxicity, and low cost. EPA believes that, with responsible development, flammable refrigerants have a role to play in the transition away from ozone-depleting substances. However, such development must adequately address safety concerns associated with manufacturing, use, servicing, and disposal of these new products. EPA is aware of several successful uses of flammable refrigerants, and welcomes future development.

The primary drawback to the use of flammable refrigerants today is that most existing systems are not designed to protect people from that flammability. In order to find a flammable refrigerant acceptable, EPA requires the completion of a risk assessment to determine the additional hazard posed by that flammability and necessary steps to mitigate any additional hazard. EPA believes hydrocarbons and other flammable refrigerants offer the potential to be good substitutes for ozone-depleting refrigerants. The best possibilities exist in the design of new equipment that includes safety features to protect against a fire or explosion. Several such systems are now being sold and developed around the world. EPA has always encouraged US businesses to consider using hydrocarbon refrigerants in such newly designed systems.

- *Has EPA found any flammable refrigerants acceptable under SNAP?*

EPA found HFC-152a acceptable for use in new household refrigerators and freezers. This determination was based on a detailed assessment of the risks posed by this flammable refrigerant in this end-use. Note that HFC-152a is not a hydrocarbon.

- *Doesn't the HFC-152a study prove that all flammable refrigerants are safe?*

No. Compare the use of HFC-152a in a newly designed refrigerator to the use of a hydrocarbon in an unmodified car. Risk from flammability varies significantly with the specific refrigerant, type of system, and system design. Hydrocarbons burn at lower concentrations in air than HFC-152a and they give off much more energy when they burn. Cars are driven at high speeds and can collide, possibly rupturing the condenser mounted just behind the grille. Finally, new refrigerators can incorporate items like enclosed switches to minimize the risk of ignition. Existing cars feature no such safety considerations since they were not designed with flammable refrigerants in mind. A risk assessment relates only to the specific end-use and refrigerant.